SECTION 500.00 – DESIGN GUIDELINES AND STANDARDS

SECTION 510.00 – INTRODUCTION

The development and preparation of a highway improvement project requires compliance with design guidelines that have been proven effective for traffic operations and highway safety based on past usage. However, design personnel are allowed sufficient flexibility to develop a cost-effective, efficient and safe highway facility that is compatible with the terrain and adjacent development.

Most nationally adopted guidelines such as AASHTO, while representing a national perspective, may not specifically address design considerations in Idaho. This chapter contains those design guidelines that are applicable to the Idaho State Highway System and that are not adequately addressed in other reference material. Additionally, this manual is more responsive to acceptable revisions than other nationally adopted publications and may represent the most recent expert opinions in design.

This chapter provides the following guideline materials:

- Additional information on existing guidelines for clarification purposes.
- Adoption of specific Idaho guidelines for situations not presently addressed in other publications.
- Adoption of revisions to existing guidelines to reflect the current design considerations, adapt to the Idaho State Highway System, or upgrade existing criteria.

Duplication of other approved design guidelines that are considered acceptable for application in Idaho is not intended. Other applicable reference publications are noted in Section 320.01.

The inclusion of these design values in this manual does not imply that existing streets and highways are unsafe or that other design criteria is not an acceptable approach to roadway facilities off the Idaho State Highway System. The values and guidelines provided herein are applicable only to new construction and improvements on the State Highway System in Idaho and exclude all maintenance activities. Modification to these design guidelines are acceptable if the modification can be justified. Modification is encouraged if the results are an improved roadway facility.

> The design guidelines contained in the Green Book (*AASHTO Policy on Geometric Design)* are basically accepted as the design criteria for the State Highway System.

510.01 Project Determination and Scope. As early as possible, a determination should be made by the Department relative to project design guidelines. Corridor Plans or appropriate standards referred to in Administrative Policy A-14-02, Roadway Widths, shall be adhered to unless lesser widths are approved as a design exception. The recommended widths in the corridor plans will be based on functional classification, area type and development, traffic volumes, safety requirements and route continuity. The recommendations shall also include consideration of community concerns and public involvement regarding environmental, scenic, historic, and preservation issues.

The project data shall be summarized and design criteria documented by completing an ITD-783, Design Concept Report. Refer to Section 300 for additional information relative to preliminary design analysis.

The following shall be used to determine project standards and FHWA oversight on projects.

PROJECT STANDARDS				
AASHTO	3R	1R	STATE	ST
Interstate (IS) New/Reconstruction NHS	3R (Resurface, Restore, Rehabilitate)	Rehabilitate	Federal Aid Non-NHS (Include all LPA Projects)	Non NHS State Funded

FHWA OVERSIGHT		
FULL	EXEMPT	NON-FEDERAL AID
IS Roadway projects greater than $300K lane/mile and Bridge projects greater than $3 million.	IS Roadway projects less than $300K lane/mile and Bridge projects less than $3 million. All other federally funded projects.	All State Funded Projects

*The Interstate is part of the National Highway System, but for clarification of this chart it is considered separate.

SECTION 515.00 – VERTICAL CLEARANCE FOR INTERSTATE STRUCTURES

All new structures are to be designed for 17 feet (5.200 m) of vertical clearance over the entire roadway including the useable width of shoulder. This clearance may be reduced with prior approval from the Roadway Design Engineer, DMV Port of Entry Manager and the Bridge Engineer, but is not to be less than 16 feet (4.9 m) (Refer to the Bridge Manual)

Any exceptions to the 16 feet (4.9 meter) vertical clearance standard for the rural interstate and the single routing in urban areas, whether the project is new construction, a project that does not provide for correction of an existing substandard condition, or a project which creates a substandard condition at an existing structure, will be coordinated with the Military Traffic Management Command Transportation Engineering Agency.

SECTION 520.00 – PASSING LANES ON TWO-LANE HIGHWAYS

The capacity of a two-way, two-lane highway is a function of several variable traffic characteristics such as traffic volumes, number of commercial vehicles, roadway width, and passing opportunity. As traffic volumes increase, traffic queues can develop and create vehicle delays because the opportunity to pass another vehicle is restricted. The passing problem can be alleviated and the capacity of a two-lane highway improved when passing lanes are provided.

The purpose of a passing lane is to reduce vehicle delays at bottleneck locations such as on steep upgrades and to break up traffic platoons that can also cause following vehicle delays. The normally applied passing lane concept on hills are classified as climbing lanes which accommodate slow moving commercial vehicles on grades while allowing other faster vehicles to pass. The application and design of climbing lanes are addressed in the Green Book.

Passing lanes are also an acceptable alternative on two-lane highways in level or rolling terrain to reduce traffic queue delays and improve the roadway capacity. Passing lanes are a cost-effective approach towards providing an adequate level of service on a two-lane facility where a four-lane highway may not be either economically nor environmentally feasible.

520.01 Need for Passing Lanes. The need for passing lanes should be based on level of service calculations in accordance with the *Highway Capacity Manual*, Chapter 8, and utilizing the traffic and roadway characteristics for the roadway segment under study. The need for passing lanes on an existing highway can be determined from a field study of traffic platooning.

Spot platooning or percentage of following vehicles is defined as the percentage of vehicles with headways (time gaps) of 5 seconds or less. This measure of spot platooning provides a lower value estimate of the percentage of time delay.

The field study should be made at several spot locations to determine the percent of vehicles delayed. The field study will provide the following data:

- Identification of localized sections where passing lanes would be desirable.
- Field evaluation of a longer roadway section having a minimum total section time delay, but includes an isolated section of higher vehicle time delays.
- Field evaluation of segments with longer platoons at relatively uniform high speeds where engineering judgment is needed to determine drivers' acceptance of the platoon speed and constraints to select their own desirable speed.

A rural, two-lane highway will normally accommodate the following AADTs, assuming the design hourly flow is fifteen percent (15%) of AADT and there is a 50/50 directional traffic distribution.

RURAL, TWO LANE HIGHWAY SERVICE TRAFFIC FLOWS EXPRESSED AS AADT (passenger car equivalents per day — 50/50 directional)							
Level of Service		Percent No Passing					
		0%	20%	40%	60%	80%	100%
Level Terrain	B	5,040	4,480	3,920	3,545	3,175	2,985
	C	8,025	7,280	6,720	6,345	6,160	5,975
	D	11,945	11,575	11,200	11,015	10,825	10,640
Rolling Terrain	B	4,855	4,295	3,545	3,175	2,800	2,425
	C	7,840	7,280	6,535	5,975	5,600	5,225
	D	11,575	10,640	9,705	8,960	8,585	8,025
Mountainous Terrain	B	4,665	3,735	2,985	2,425	2,240	1,865
	C	7,280	6,160	5,225	4,295	3,735	2,985
	D	10,825	9,335	8,400	7,465	6,905	6,160

The values in the table above can be adjusted for uneven directional distribution of traffic, lane, and shoulder width. The values are expressed as passenger car equivalents per day; requiring that the effects of heavy vehicles, trucks, buses, and recreational vehicles in the traffic stream be converted to equivalent passenger car volumes.

The minimum level of service criteria for two-lane highways related to time delay is as follows:

Level of Service	Percentage of Time Delay on General Segments
A	30% or less
B	45% or less
C	60% or less
D	75% or less
E	75% or more
F	100%

If the traffic volumes (equivalent to passenger cars/day) exceed the tabular ADTs, or if the spot time delays exceed the value for the selected level of service, then passing lanes should be considered.

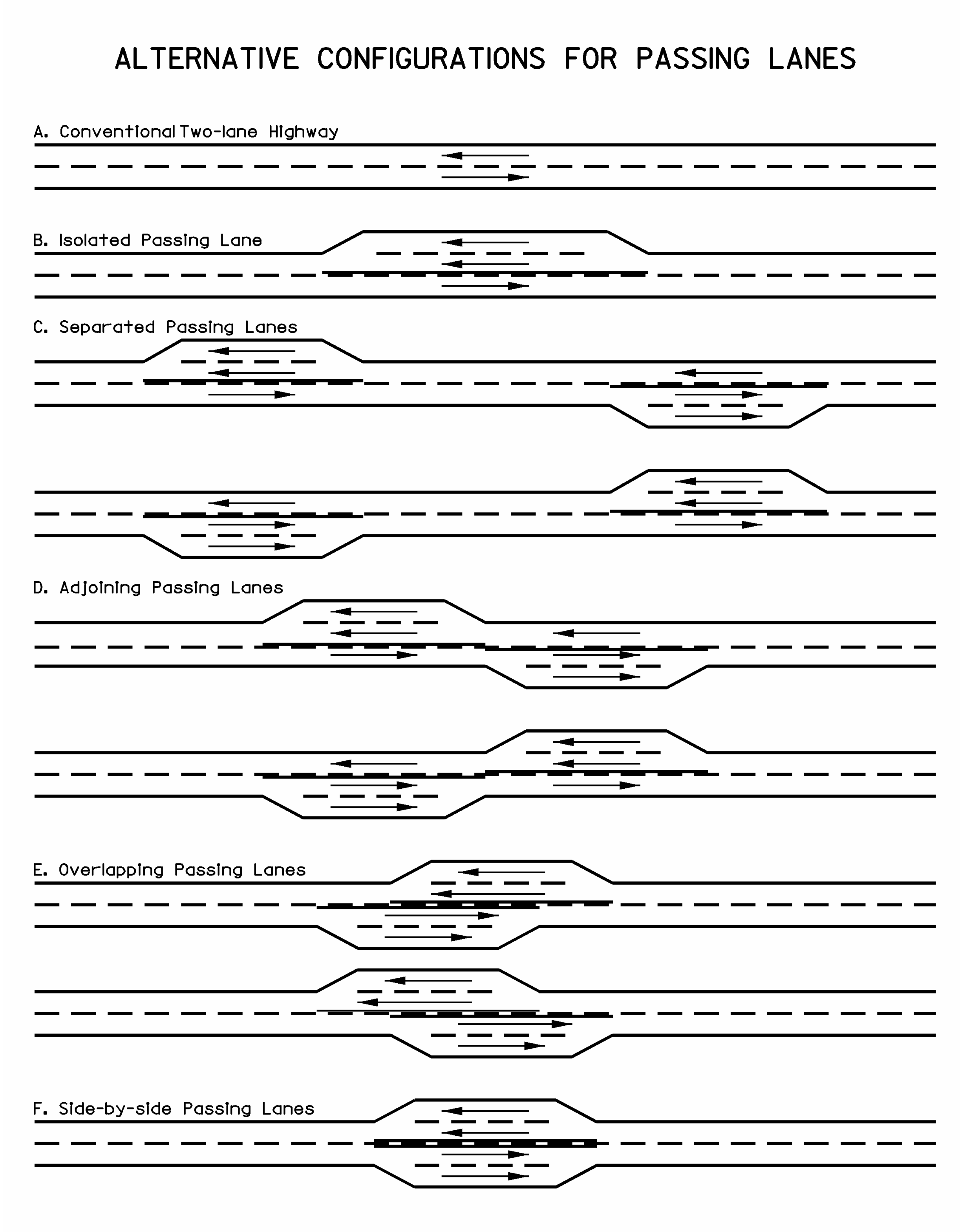
> Any geometric improvements to the existing highway can affect field data, making the above level of service criteria erroneous.

520.02 Location of Passing Lanes. The location and configuration of a passing lane may be influenced by the need to alleviate an operational problem, adjacent development, terrain, or other factors. The following objectives should be considered relative to location:

- Choose a location that minimizes construction costs.
- Passing lane location should appear logical to the driver, i.e., on grades or where passing sight distance is restricted.
- Location should provide adequate sight distance for entrance and termination.
- Physical constraints such as bridges, culverts and vertical cuts or drop-offs should be avoided because of costs.
- Passing lanes can also be considered when a realignment shift is needed to provide the width in the appropriate direction.

The configuration of multiple passing lanes are shown in Figure 5-1, with desirable and undesirable patterns noted. If separate passing lanes are used, the lanes should be separated by at least 1500 feet (460 m) to reduce any conflicts between opposing traffic flows.

Figure 5-1


ALTERNATIVE CONFIGURATIONS FOR PASSING LANES
A. Conventional Two-lane Highway
B. Isolated Passing Lane
C. Separated Passing Lanes
D. Adjoining Passing Lanes
E. Overlapping Passing Lanes
F. Side-by-side Passing Lanes

520.03 Length and Spacing. The minimum length of passing lanes should be 0.25 mile (0.40 km) since anything shorter in length is not effective in reducing traffic platooning. Design lengths for passing lanes should be:

One-Way Flow Rate (Veh/Hr)	Optimal Passing Lane Length (mi [km])
100	0.50 (.80)
200	0.50 – 0.75 (.80-1.2)
400	0.75 – 1.00 (1.2-1.6)
700	1.00 – 2.00 (1.6-3.2)

The spacing of passing lanes will depend primarily on the need to achieve satisfactory traffic operation. Normally, the operational benefits of a passing lane typically extend down stream from 3 to 8 miles (5 to 12 km). It is usually desirable to provide passing lanes at longer spacing with plans for intermediate passing lanes as the traffic volume increases. However, the spacing must be flexible to permit selection of suitable and inexpensive sites.

520.04 Geometrics. The geometrics of the passing lane should be similar to the adjacent two-lane highway. A minimum lane width of 12 feet (3.6 meters) is desirable with an adequate shoulder. The shoulder for the adjacent two-lane highway should be carried through the passing-lane section. The normal practice is to drop the right-hand lane, merging the traffic with the left lane (i.e., passing lane). Roadway transition length at the start and end of the passing-lane section should be in accordance with the Green Book.

520.05 Traffic Control Devices. The pavement markings, delineations and signing should conform to the *Manual on Uniform Traffic Control Devices*. Additionally, periodical signing along a highway segment with passing lanes to advise motorists of the distance to the passing lane is desirable. This advance signing will reduce driver impatience and reduce forced passing maneuvers.

SECTION 525.00 – PAVEMENT EDGE SLOPE

The vertical or near vertical face of pavement edges effects the steering and recovery of a vehicle onto a surfaced roadway when the right wheels drop over the pavement edge. Backfilling against the pavement edge with foreslope material is a temporary solution. Roadway drainage tends to flow along the pavement edge, eroding this backfill material and causing either a re-occurring maintenance requirement or an exposed pavement edge.

Asphalt pavement design must consider the requirement for future pavement overlays and a need to backfill foreslopes against a new overlay. The roadway foreslopes with each overlay requires additional material and can disturb existing established plant growth adding to the potential for slope erosion.

Pavement construction provisions in Idaho for asphalt pavements require a shoe on the edge of asphalt laydown machines to provide a tapered edge on the asphalt mat.

- On initial pavement placement, the shoe may be 18 inches (450 mm) wide for pavement depths of 0.2 feet (60 mm) or less.
- For depths greater than 0.2 feet (60 mm) the shoe shall be 24 inches (600 mm) wide.
- On all pavement overlays the shoe shall be 24 inches (600 mm) wide.

SECTION 530.00 – CURVE RADIUS VALUES

(REMOVED)

SECTION 535.00 - SUPERELEVATION

The guidelines for superelevation, and superelevation runoff length, are provided in the Green Book, Chapter III, "Elements of Design." The accepted standard rate of superelevation used in Idaho shall be based on the following:

535.01 Maximum Superelevation. The maximum rate of superelevation shall be 0.08 foot/foot (8%), except that the following should be considered:

- Mountainous terrain where significant snow and ice may be encountered 0.06 foot/foot (6%)
- Slower speed curves 0.06 foot/foot (6%)
- Urban typical sections 0.04 foot/foot (4%)
- Low-speed curves approaching a stop condition 0.04 foot/foot (4%)
- Interchange ramps 0.06 foot/foot (6%)
- Curves through intersections with public roads 0.06 foot/foot (6%)

535.02 Axis of Rotation – General. The axis of rotation for superelevation runoff shall normally be about the centerline of the roadway as shown in Figure 5-4 except as follows:

- Curves in cut sections and grades flatter than 1.2% should be rotated around the inner edge of the traveled way. Drainage must be checked for adequacy on grades flatter than 0.75%.
- Curves in flat country at the end of tangents approximately three miles long or longer should be rotated about the inner edge of the traveled way to improve the driver's perception of the curve.
- Special combinations of horizontal alignment, grades, and topography may indicate that the roadway should be rotated about one or the other of the edges.

535.03 Axis of Rotation – Divided Highways. On four-lane divided highways, the axis or axes of rotation should normally be the center of traveled way or as shown in Figure 5-5. Consideration should be given to the size and design of the median, as well as minimum critical grades for drainage. The following items should be considered:

- Raised and/or depressed medians up to 40 feet (12 meters) in width may be rotated about the edges of the median. When the median is paved flush with the travel lanes, a single axis of rotation should be used. Straight superelevation across paved medians make it easier to construct median guardrail, left-turn bays and intersections with crossroads.

For medians greater than 40 feet (12 meters) in width, the axis of rotation will be about their respective centerlines, except for situations outlined under two-lane highways.

Figure 5-4

ITD 1767 6-94
Form use : Mtce Projects

Design

metric

SUPERELEVATION

SUPERELEVATION RUNOFF ON CENTER CROWN ROADWAY

EXAMPLE SHOWN : (110 km/h) DESIGN SPEED, 500 m R CURVE TO THE RIGHT

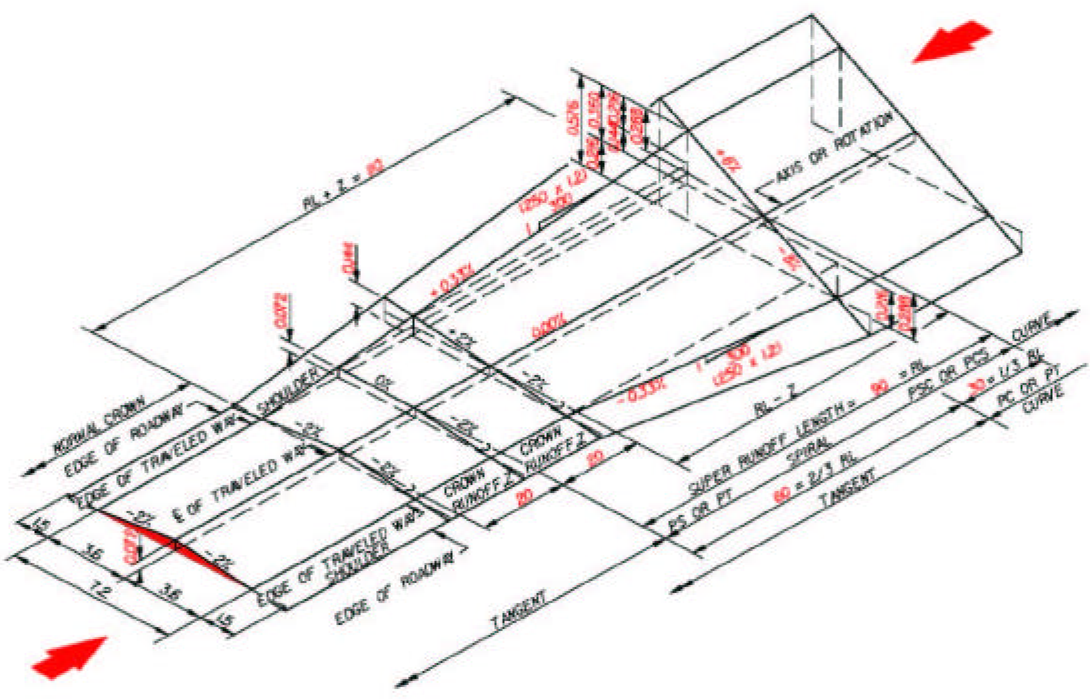


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Figure 5-5

ITD 1767 9-97
Form use : Mtce Projects

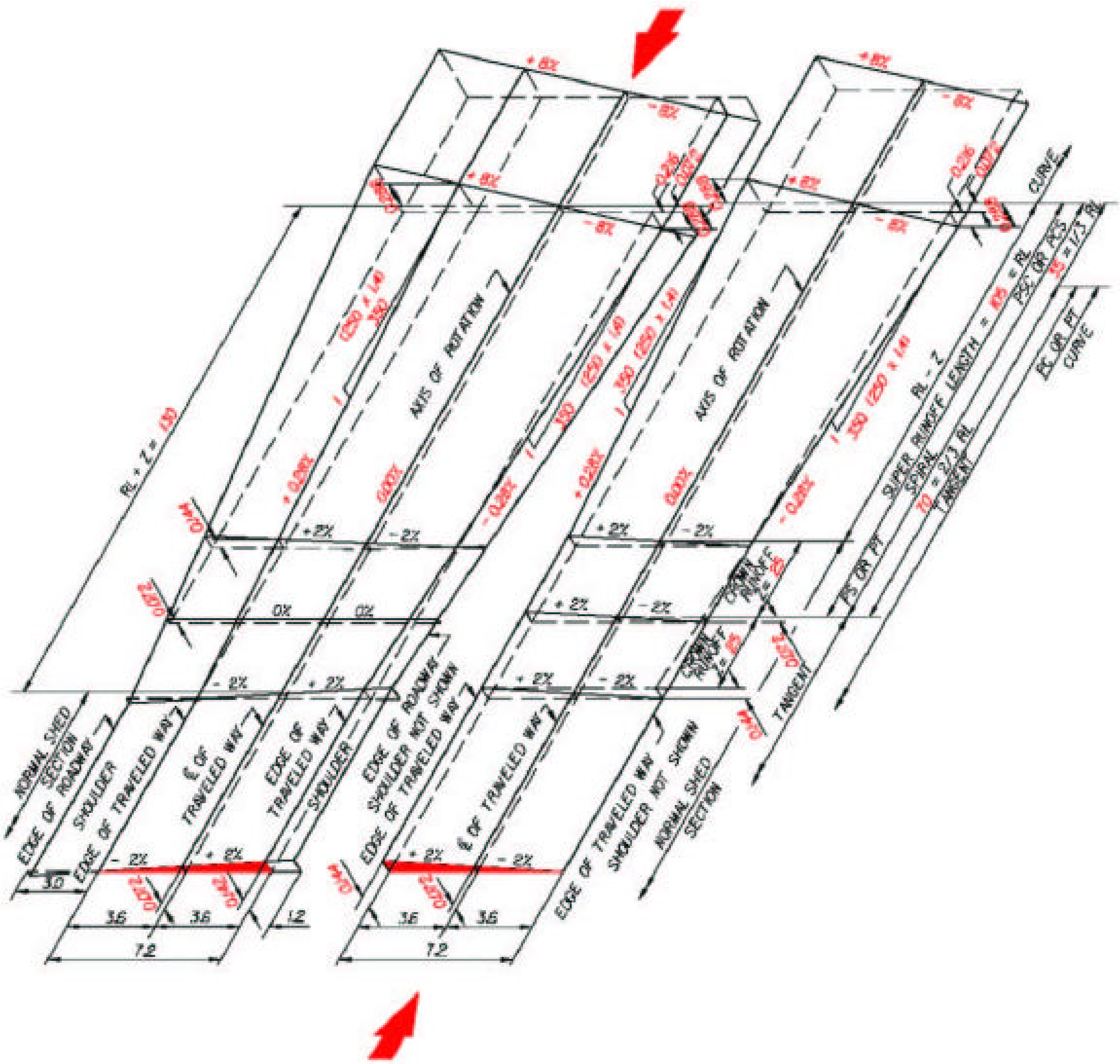
Design

metric

SUPERELEVATION

SUPERELEVATION RUNOFF ON SHED SECTION ROADWAY

EXAMPLE SHOWN : (110 km/h) DESIGN SPEED, 500 m R CURVE TO THE RIGHT



CADD DWG. 6_051098.dgn

535.04 Superelevation Runoff Lengths. The superelevation runoff length shall be obtained from the design superelevation tables for general design conditions and from the provided formula for low-speed urban streets in "Elements of Design," Chapter III, in the Policy on Geometric Design.

The Z distance (runoff length from normal crown to flat section) shall be calculated from the following formula:

$$Z = \frac{NC}{e}(RL)$$

Where:

Z	=	Runoff length from normal crown to flat section
NC	=	Normal crown rate %
e	=	Superelevation rate %
RL	=	Runoff Length (from design superelevation tables)

Distances may be rounded to the nearest 25 feet (10 m) for both Z and RL.

Normally two-thirds (2/3) of the superelevation runoff length is placed before the P.C. or after the P.T. of the horizontal curve.

This method of calculating the runoff length and Z distance is consistent with the engineering software currently being used by the Idaho Transportation Department.

535.05 Superelevation Runoff Between Adjacent Curves. The superelevation runoff length and transition into and out of full superelevation on horizontal curves must be reviewed carefully where there are two adjacent curves. Frequently, an unnecessary dip in the shoulder elevation or "birdbath" will occur when the superelevation is rotated about the control line as the superelevation is transitioned from a horizontal curve to tangent to another horizontal curve. Correction of this problem on the plans will ensure appropriate subgrading to eliminate expressive correction with the roadway surfacing.

Therefore, the pavement edge profile **MUST** be reviewed carefully, viewed from the driver's perspective, and adjusted to eliminate these unnecessary dips or "birdbaths." Two adjacent horizontal curves should be separated by sufficient tangent distances to eliminate any overlap of superelevation runoff length between the two curves.

> Roadway tangent length between two adjacent horizontal curves would normally be two-thirds (2/3) of the sum of the superelevation runoff lengths plus the tangent runoff lengths (Z) for the two respective curves.

Field conditions may require the location of two adjacent horizontal curves closer than the above minimum tangent distance. Also, a minimum of 200 feet (60 m) of normal crown roadway is desirable between two consecutive horizontal curves. If this 200 feet (60 m) minimum cannot be obtained, the superelevation runoff length should be extended to meet at a proportionate point between the curves. The superelevation runoff lengths should be increased until they abut, thus providing one single-level cross section.

535.06 Safe Speed for Horizontal Curves. The figures and tables in Chapter III of the AASHTO Policy of Geometric Design provide a convenient reference for determining the safe speed without doing the calculations when the degree of curve/radius and superelevation are known. If design speed and maximum allowable superelevation are established, the maximum allowable degree of curve/radius may be determined from the Safe Speed Graphs.

The advisory safe speed of horizontal curves can be determined by the following formula as shown on the Green Book page 143..

$$v = \sqrt{R_{min} \times 127 \left(\frac{e_{max}}{100} + f_{max} \right)}$$

Where:

V	=	Advisory safe speed of curve in km/h
fmax	=	Allowable side friction factor
emax	=	Superelevation in %
Rmin	=	Minimum radius

The allowable side friction factors for rural highways and high speed urban streets is shown in Exhibit 3-13, page 144 in the Green Book. For low speed urban streets, the allowable side friction factors is shown in Exhibit 3-39.

SECTION 540.00 – ACCESS CONTROL

The control of highway access shall be considered on all new highway improvements. Full control of access shall be provided and maintained on the Interstate Highway System and other designated high priority primary highways. Either partial control of access or the standard approach policy shall be considered for other highway improvements. The general requirements and guidelines for partial control of access are defined in Administrative policy A-12-01, State Highway Access Control.

Where a highway connects to a facility with full control of access via an interchange, the full control of access shall be extended each direction outside the ramp terminals as outlined in Figure 5-6. If economic considerations or physical limitations require that a public road or an approach be located closer than 300 feet (92 m), appropriate analysis and justification shall be prepared for Roadway Design approval. When acceleration or deceleration lanes are provided on the interchange crossroads, then the full control of access limits shall be carried 100 feet (30.5 m) beyond the extra lane or 300 feet (92 m), whichever is greater.

SECTION 545.00 – HIGHWAY LOCATION RELATING TO PROPERTY OWNER LINES

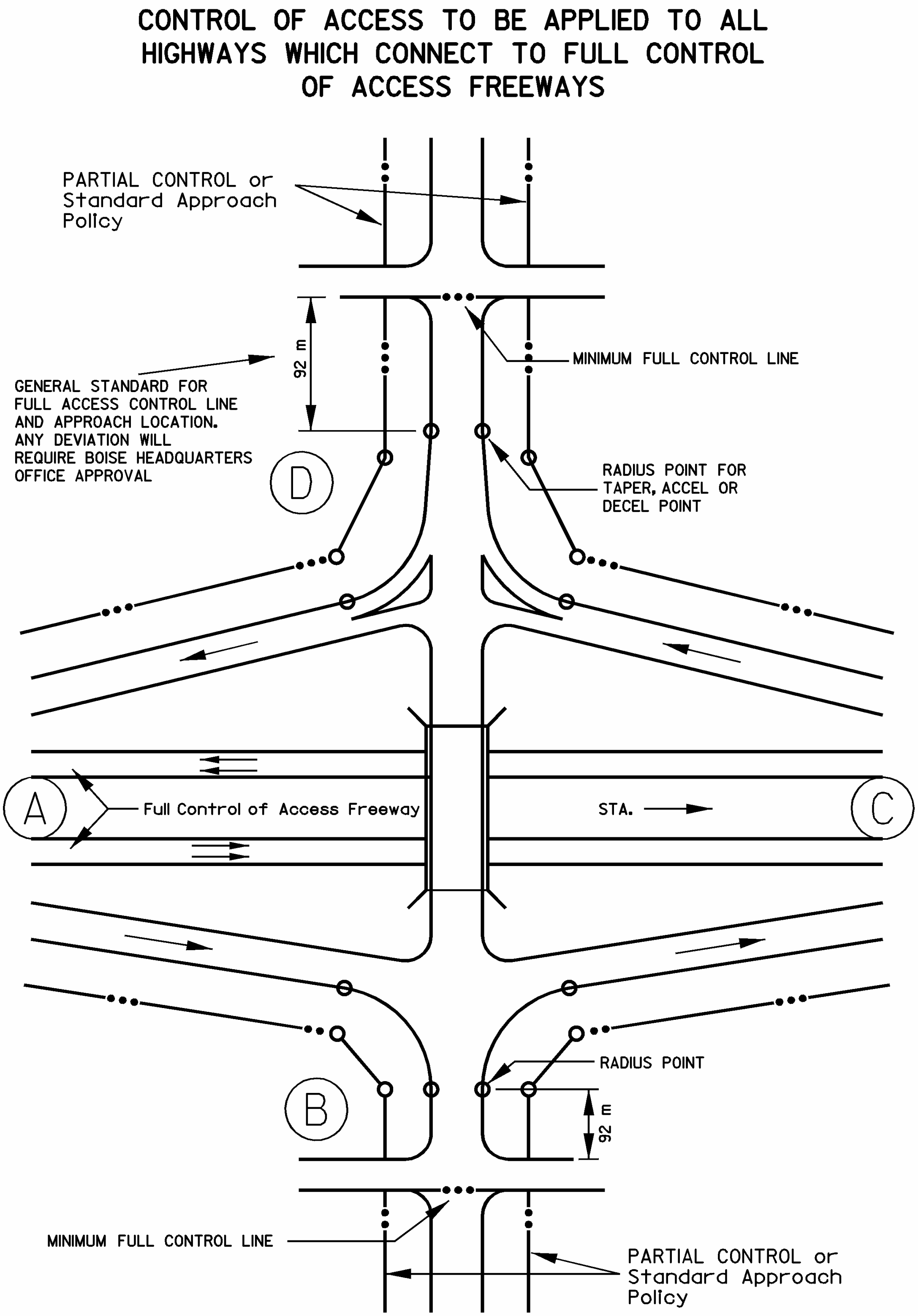
Where the new location of a highway is along property lines, the most desirable option is to take right-of-way from both properties rather than to lay to one side and take from one side only. However, economic and/or engineering features of the location shall be the controlling factors and may dictate the taking of right-of-way from one side.

SECTION 550.00 – MEDIAN CROSSOVERS

Median crossovers may be required on 4-lane divided highways for emergency and maintenance turnarounds when interchanges are located at greater than 5 mile (8 kilometers) spacing. The District Engineer shall approve all new median crossovers, either as a portion of a construction project or an addition after initial construction. FHWA approval is required for median crossovers on the interstate. A request for a median crossover should outline the need and include a sketch showing the location relative to other highway features, planned design concept, milepost location, photos, as-built drawings, traffic data, accident data and environmental impacts. If insufficient information is provided, the request could either be denied or delayed until the necessary information has been assembled and/or a field review and site analysis has been completed.

Generally, the median crossover should be constructed at least1500 feet (460 m) from existing or planned ramp tapers. Existing median crossovers that are located closer than 1500 feet (460 m) to a ramp should be field evaluated for traffic operational problems, terrain considerations, and sight distance. If feasible, the median crossover shall be rebuilt to existing standards and relocated to new distance requirements. Existing median crossovers that are not required for emergency or maintenance purposes shall be removed. The design of median crossovers shall be in accordance with Standard Drawing A-7.

Figure 5-6


CONTROL OF ACCESS TO BE APPLIED TO ALL HIGHWAYS WHICH CONNECT TO FULL CONTROL OF ACCESS FREEWAYS
PARTIAL CONTROL or Standard Approach Policy
92 m
MINIMUM FULL CONTROL LINE
GENERAL STANDARD FOR FULL ACCESS CONTROL LINE AND APPROACH LOCATION. ANY DEVIATION WILL REQUIRE BOISE HEADQUARTERS OFFICE APPROVAL
D
RADIUS POINT FOR TAPER, ACCEL OR DECEL POINT
A
Full Control of Access Freeway
STA.
C
RADIUS POINT
B
92 m
MINIMUM FULL CONTROL LINE
PARTIAL CONTROL or Standard Approach Policy

SECTION 555.00 – DESIGN FOR OVERSIZED VEHICLES

Intersections on the State Highway System should be designed to accommodate the trucks using the system. The AASHTO guidelines provide vehicle dimension information and minimum turning templates for various sizes and combinations of commercial vehicles. The Traffic section also has turning templates for various scales on transparencies. The templates are particularly useful for intersection design to determine offtracking and channelization adjustments. A software product (AutoTurn) is available for determining offtracking in the CADD environment.

The Idaho Transportation Board has designated specific highway routes for special vehicle combinations as outlined in the *Overlegal Permit Conditions* manual. Any highway design for these specific routes should accommodate the specified vehicle combination. Please note that for special vehicle authorization, the vehicle is permitted to travel from the designated highway route to appropriate terminals or vehicle breakdown areas. Highway interchanges and intersections must be designed to allow the extra-length vehicle to make appropriate turns to access the local terminal or breakdown area. However, this accommodation of turning maneuvers does permit encroachment on other traffic lanes and shoulders providing encroachment into opposing traffic lanes is minimized. The amount of encroachment permitted prior to a turn and in completing a turn shall be consider in the total traffic volumes and the ability of the extra-length vehicle to make the turning maneuver under forecasted traffic volumes.

The following guidelines are suggested for selecting the design vehicle and design application for a particular intersection to accommodate oversize vehicles:

555.01 Oversize Vehicles Offtracking. The offtracking of commercial vehicles must be considered on all horizontal curves with particular attention on ramps and at intersections. For track width and overhang determinations, see Green Book figures III-22 A and B.

> Narrower roadways (under 30 feet (9 m) total width) may require curve widening dependent on the size of the vehicle allowed and sharpness of the curvature.

To accommodate large vehicles or vehicle combinations, the sharp curvature of alignment such as ramps, turning roadways, or auxiliary lanes may require specific consideration of offtracking and curve widening. Diagrams and formulas for computing the offtracking requirement for the following three application cases are found in the *AASHTO Green Book* in Exhibit 3-47 Each of these cases considers the potential conflict of an extra-length vehicle with another vehicle of comparable offtracking consideration passing on a curved roadway.

Case 1 - One-lane roadway operation with no passing.

Case 2 - One-lane roadway with provision for passing a stalled vehicle.

Case 3 - Two-lane roadway with provision for meeting or passing another vehicle.

555.02 Intersection Design for Oversize Vehicles. The design vehicles that will be accommodated on highway improvement projects, potential terminal facility locations, and interchange or intersection offtracking considerations shall be established at the project concept review stage. Intersections on the State Highway System should be designed using the WB-19 truck and 48 feet (14.6 m) semitrailer. All moves should be possible without running over curbs, edge of pavement, or encroaching into conflicting traffic lanes.

Provisions for the WB-19 on county arterials and major collectors should also be made. On all local roads, except those where trucks are prohibited, the intersections should be designed so that a WB-15 Design Vehicle can at least make all the turning moves without running over the curbs or off the roadway.

When using the SU standard turning template to design pavement markings through an intersection, the edge lines and channelization lines are normally located 2 feet (0.6 m) outside the track width shown on the turning templates. For the larger design trucks and physical obstructions such as curbs, raised islands and edge pavements, the desirable clearance is 3 feet (0.9 m) between the track width. In no case should the markings be less than 2 feet (0.6 m).

These guidelines may not provide a cost-effective design in some situations. The situation should be analyzed recognizing traffic volumes, special truck volumes, encroachment on other lanes, and construction costs to provide a reasonable design.

555.03 Oversize Vehicle Considerations for Interchange Areas. Interchange areas should be designed using the WB-33D (truck and two semitrailers – 45 feet (13.7 m) each. All moves should be possible without running over curbs, edge of pavement, or encroaching into conflicting traffic lanes at all interchanges with a State highway or major off-system highway on the crossroads. A WB-19 template can be used on low volume interchanges where the use of WB-33D trucks is not anticipated. The DMV Port of Entry Manager can supply information regarding the anticipated WB-33D traffic volumes at specific interchanges.

555.04 Oversize Vehicle Considerations for Pavement Markings. Pavement markings (lane lines, centerlines, channelizing lines and painted islands) should be designated by using the SU truck. All moves should be possible without encroaching on the pavement markings. Edge lines should be located a minimum of 2 feet (0.6 m) from the edge of pavement on the inside edge of a curve and guide the motorist along a natural path.

SECTION 560.00 – INTERSECTION CHANNELIZATION GUIDELINES

The general design criteria for intersections and channelization are provided in the Green Book. Additional criteria and helpful suggestions are also included in *NCHRP Report 279*, "Intersection Channelization Design Guide". However, the above-mentioned reference material relative to trucks, vehicle operating characteristics, curb radii, and other user data should be updated to conform with the most recent AASHTO policy.

560.01 Intersection Sight Distance. The Green Book outlines the desirable assumptions and criteria for intersection sight distance that should be considered for new construction. However, these requirements may not be applicable to the operation of existing intersections and need only be considered if the intersection is being completely reconstructed. Terrain features, roadway alignment, major buildings, or other significant obstructions may exist that prevent attaining these desirable sight distances; however, the minimum intersection sight distance should not be less than the minimum vehicle stopping sight distance as reflected under the “Elements of Design,” in the Green Book.

The application of special signing of safe approach speeds for limited intersection sight distance problems on either roadway is usually not very effective. Drivers usually do not perceive that there is sight distance limitations and are hesitant to reduce vehicle operating speeds when there are neither geometric nor apparent operational constraints. Limited intersection sight distance problems can be partially corrected by installing traffic control, such as a stop sign on a minor roadway, curb lines, crosswalks, and stop bars to ensure that a driver has adequate sight distance to enter or cross the major roadway safely.

In all intersection configurations and operational cases, the roadway design and minimum motorist sight distance must allow for collision avoidance. Avoidance can be accomplished by using, in the most restrictive cases, an approach "stop" control on the minor approach, and by providing minimum stopping sight distance on the major roadway.

SECTION 565.00 – ROADSIDE CLEAR ZONES

The roadside clear zone is an area, outside the roadway traffic lane, that is clear of obstacles, steep slopes, cut sections, or other features that would interfere with a motorist controlling his/her vehicle or may result in a collision. Ideally the roadside would be traversable throughout its length and contain no fixed objects, or, if significant hazards existed, shielding would be used to prevent a collision with the hazardous feature. Since this approach is seldom cost effective, appropriate ranges of clear zone distances rather than an absolute number are shown in following table.

565.01 Clear Zone Criteria. The area within the clear zone shall meet one of the following criteria:

- The roadside is cleared of all obstructions within the appropriate clear zone distance (see Figure 5-7).
- The cleared distance is justified by a cost-effective analysis using the program in the 2002 *AASHTO Roadside Design Guide*.
- Determination of whether a fixed object or non-traversable terrain feature warrants relocation, modification, removal, shielding, or no treatment by application of the concepts in Section 3.3 "Application of the Clear Zone Concept" of the 2002 *AASHTO Roadside Design Guide*.

> The clear zone distance that is selected shall be noted in the Concept Report, ITD-783A(ITD-0757), Design Standards. Any deviations shall be analyzed and the analysis shall be attached to the Concept Report for approval.

Figure 5-7

Clear Zone Distances (Distance from edge of driving lane) ENGLISH

DESIGN SPEED	DESIGN ADT	FILL SLOPES			CUT SLOPES		
		6:1 or flatter	5:1 to 4:1	3:1	3:1	5:1 to 4:1	6:1 or flatter
40 mph	Under 750	7-10	7-10	**	7-10	7-10	7-10
	750-1500	10-12	12-14	**	10-12	10-12	10-12
	1500-6000	12-14	14-16	**	12-14	12-14	12-14
	Over 6000	14-16	16-18	**	14-16	14-16	14-16
45-50MPH	Under 750	10-12	12-14	**	8-10	8-10	10-12
	750-1500	12-14	16-20	**	10-12	12-14	14-16
	1500-6000	16-18	20-26	**	12-14	14-16	16-18
	Over 6000	18-20	24-28	**	14-16	18-20	20-22
55mph	Under 750	12-14	14-18	**	8-10	10-12	10-12
	750-1500	16-18	20-24	**	10-12	14-16	16-18
	1500-6000	20-22	24-30	**	14-16	16-18	20-22
	Over 6000	22-24	26-32*	**	16-18	20-22	22-24
60mph	Under 750	16-18	20-24	**	10-12	12-14	14-16
	750-1500	20-24	26-32*	**	12-14	16-18	20-22
	1500-6000	26-30	32-40*	**	14-18	18-20	24-26
	Over 6000	30-32*	35-44*	**	20-22	24-26	26-28
65-70mph	Under 750	18-20	20-26	**	10-12	14-16	14-16
	750-1500	24-26	28-36	**	12-16	18-20	20-22
	1500-6000	28-32*	34-42*	**	16-20	22-24	26-28
	Over 6000	30-34*	38-46*	**	22-24	26-30	28-30

Figure 5-7a

Clear Zone Distances (Distance from edge of driving lane)METRIC

DESIGN SPEED	DESIGN ADT	FILL SLOPES			CUT SLOPES		
		1:6 or flatter	1:5 to 1:4	1:3	1:3	1:5 to 1:4	1:6 or flatter
60 km/h or less	Under 750	2.0-3.0	2.0-3.0	**	2.0-3.0	2.0-3.0	2.0-3.0
	750-1500	3.0-3.5	3.5-4.5	**	3.0-3.5	3.0-3.5	3.0-3.5
	1500-6000	3.5-4.5	4.5-5.0	**	3.5-4.5	3.5-4.5	3.5-4.5
	Over 6000	4.5-5.0	5.0-5.5	**	4.5-5.0	4.5-5.0	4.5-5.0
70-80 km/h	Under 750	3.0-3.5	3.5-4.5	**	2.5-3.0	2.5-3.0	3.0-3.5
	750-1500	4.5-5.0	5.0-6.0	**	3.0-3.5	3.5-4.5	4.5-5.0
	1500-6000	5.0-5.5	6.0-8.0	**	3.5-4.5	4.5-5.0	5.0-5.5
	Over 6000	6.0-6.5	7.5-8.5	**	4.5-5.0	5.5-6.0	6.0-6.5
90 km/h	Under 750	3.5-4.5	4.5-5.5	**	2.5-3.0	3.0-3.5	3.0-3.5
	750-1500	5.0-5.5	6.0-7.5	**	3.0-3.5	4.5-5.0	5.0-5.5
	1500-6000	6.0-6.5	7.5-9.0	**	4.5-5.0	5.0-5.5	6.0-6.5
	Over 6000	6.5-7.5	8.0-10.0*	**	5.0-5.5	6.0-6.5	6.5-7.5
100 km/h	Under 750	5.0-5.5	6.0-7.5	**	3.0-3.5	3.5-4.5	4.5-5.0
	750-1500	6.0-7.5	8.0-10.0*	**	3.5-4.5	5.0-5.5	6.0-6.5
	1500-6000	8.0-9.0	10.0-12.0*	**	4.5-5.5	5.5-6.5	7.5-8.0
	Over 6000	9.0.-10.0*	11.0-13.5*	**	6.0-6.5	7.5-8.0	8.0-8.5
110 km/h	Under 750	5.5-6.0	6.0-8.0	**	3.0-3.5	4.5-5.0	4.5-4.9
	750-1500	7.5-8.0	8.5-11.0*	**	3.5-5.0	5.5-6.0	6.0-6.5
	1500-6000	8.5-10.0*	10.5-13.0*	**	5.0-6.0	6.5-7.5	8.0-8.5
	Over 6000	9.0-10.5*	11.5-14.0*	**	6.5-7.5	8.0-9.0	8.5-9.0

** Where a site specific investigation indicates a high probability of continuing accidents, or such occurrences are indicated by accident history, the designer may provide clear zone distances greater than 9 meters as indicated. Clear zones may be limited to 9 meters for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.*

*** Since recovery is less likely on the unshielded, traversable 3:1 (1:3) slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of the slope. Determination of the width of the recovery area at the toe of the slope should consider right-of-way availability, environmental concerns, economic factors, safety needs, and accident histories. Also, the distance between the edge of the travel lane and the beginning of the 3:1 (1:3) slope should influence the recovery area provided at the toe of the slope.*

565.02 Clear Zone Modifications. The designer may also choose to modify the clear zone distance for horizontal curvature by using the following table. These modifications are normally only considered where accident histories indicate a need; or a specific site investigation shows a definitive accident potential which could be significantly lessened by increasing the clear zone width and the increase is cost effective.

HORIZONTAL CURVE ADJUSTMENT Kcz (Curve Factor)

Radius as Curve (Meters)	Design Speed (km/h)					
	60	70	80	90	100	110
900	1.1	1.1	1.1	1.2	1.2	1.2
700	1.1	1.1	1.2	1.2	1.2	1.3
600	1.1	1.2	1.2	1.2	1.3	1.4
500	1.1	1.2	1.2	1.3	1.3	1.4
450	1.2	1.2	1.3	1.3	1.4	1.5
400	1.2	1.2	1.3	1.3	1.4	
350	1.2	1.2	1.3	1.4	1.5	
300	1.2	1.3	1.4	1.5	1.5	
250	1.3	1.3	1.4	1.5		
200	1.3	1.4	1.5			
150	1.4	1.5				
100	1.5					

The following formula is used to figure the clear zone distance for horizontal curvatures:

$$CZc = (Lc)\ (Kcz)$$

Where: CZc = clear zone of curvature in meters
Lc = clear zone distance in meters
Kcz = curve correction factor

Example Problem(English):
Design Speed =60 mph, 3.5 curve, ADT = 2000, 4:1 side slope
CZc = (Lc) (Kcz) = (32) (1.32) = 42.2.

Use clear zone outside curve = 42 feet

Example Problem(Metric):
Design Speed =110 km/h, 700 m Radius curve, ADT>6,000, 1:6 sideslope
CZc = (Lc) (Kcz) = (9) (1.3) = 11.7 m

Clear zone correction factors are applied to outside of curves only.
Curves flatter than 2865 feet (900 m) Radius (2.0 degrees)
do not require an adjusted clear zone.

Isolated objects that are located on the roadside, but are outside the selected clear zone distance should be analyzed for cost-effectiveness to determine the optimal solution.

Application of clear zone distances may be limited by physical factors, but an additional factor that must be considered when determining a maximum desirable recovery area is the fill slope parameters.

SECTION 570.00 – GUARDRAIL

The purpose of guardrail is to make highway improvements safer by reducing accident severity. Properly designed installations reduce accident severity by:

- Preventing errant vehicle penetration; (Guardrail reduces accident severity by excluding vehicles from dangerous areas.)
- Redirecting errant vehicles to a direction parallel to the traffic flow, thus minimizing danger to following adjacent traffic flow; and
- Minimizing hazards to vehicle occupants during impact.

Desirable guardrail performance characteristics are:

- Minimizing vehicle damage so the auto can be maneuvered after impact;
- Being resistive to impact damage;
- Being economical in construction, installation, and maintenance; and
- Having a pleasing and functional appearance.

570.01 Guardrail on Scenic Routes. Many of the highways in Idaho traverse areas where the “scenic view” from the vehicle is important to the occupants. Many of these areas are located along streams, high fill area, or other hazards that warrant extensive use of guardrail.

Recognizing that the installation of guardrail impairs the scenic value of an area, the following guide is given for these areas.

- Administrative Policy A-14-11, Guardrail Installations, will be followed in determining the type of guardrail to be used and the definition of scenic routes.

> The actual installation of guardrail on scenic routes may be limited to areas with a high accident potential such as the outside of curves and high precipices.

570.02 Guardrail Placement Determination. Guardrail placement determination is also based on physical characteristics of the roadway and are applicable to highways in general. Where guardrail installations are indicated, the designer should examine the roadway to determine the feasibility of adjusting site features (e.g., flattening an embankment slope or removing a tree) so guardrails would not be required. For borderline cases the action guideline is: GATHER MORE DATA.

Detailed analysis of guardrail determination and design should be based on this manual and the *AASHTO Roadside Design Guide*. Guardrail installations may be required by any combination of the following shoulder features:

- Embankment geometry,
- Roadside obstacles (e.g., drop-off) in close proximity to the roadway, and
- Nontraversable roadside hazards.

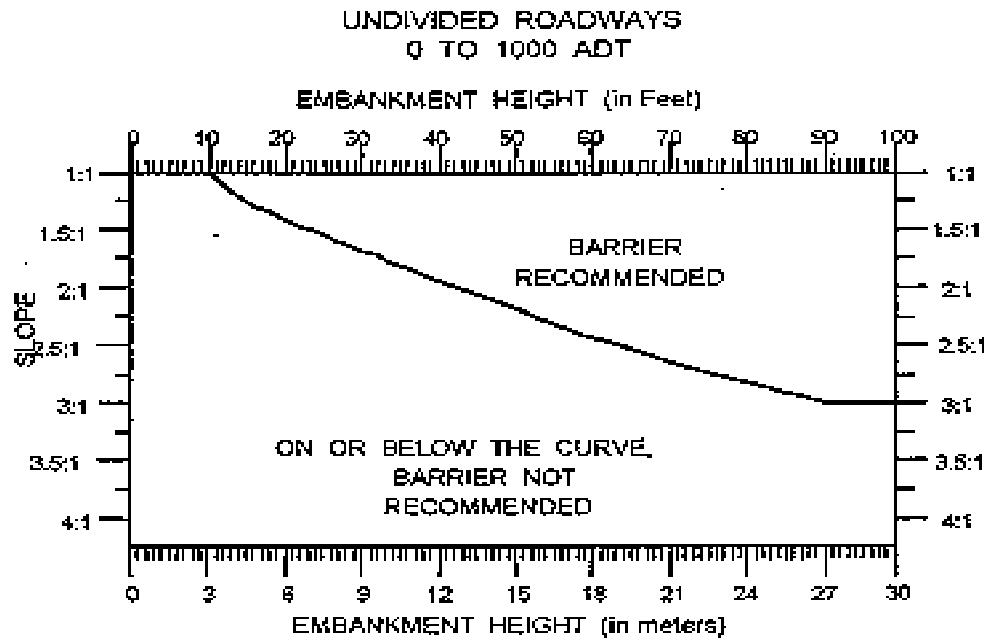
Actual accident experience for specific sections of highway may also dictate guardrail placement even though guardrail installation may not have been indicated by these guidelines.

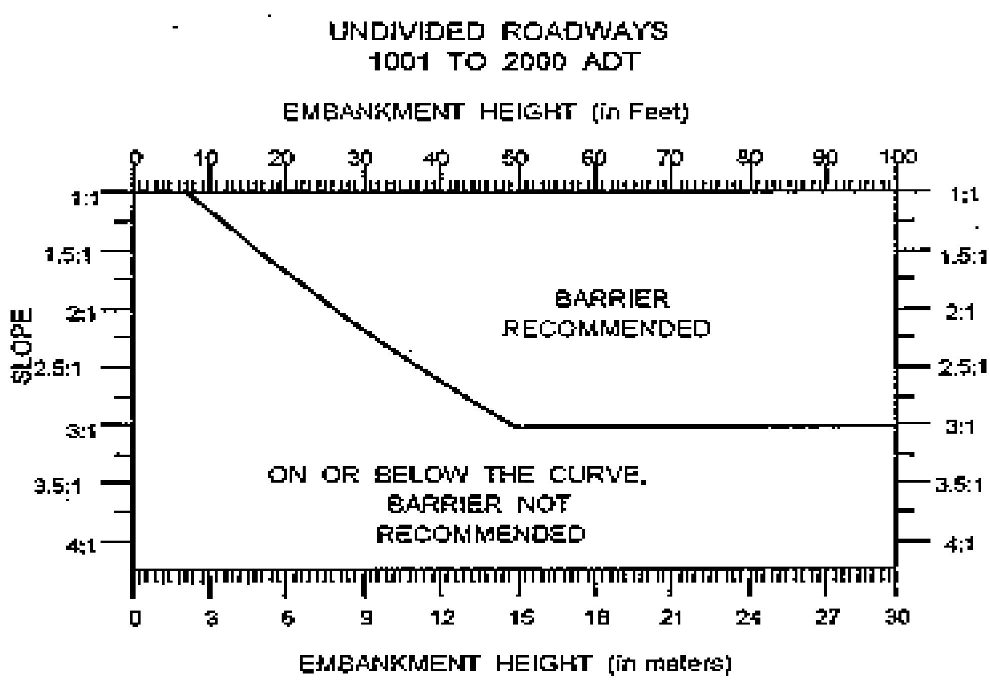
570.03 Guardrail Installation. Guardrail installations, at best, are formidable roadside hazards and provide errant vehicles with only a relative degree of protection. Although guardrail installations should decrease accident severity, the frequency of accident occurrence may increase with some guardrail installations because the guardrail system is usually a larger target and is located closer to the roadway.

> Guardrail installations should be kept to a minimum and installation should be considered only when clearly justified.

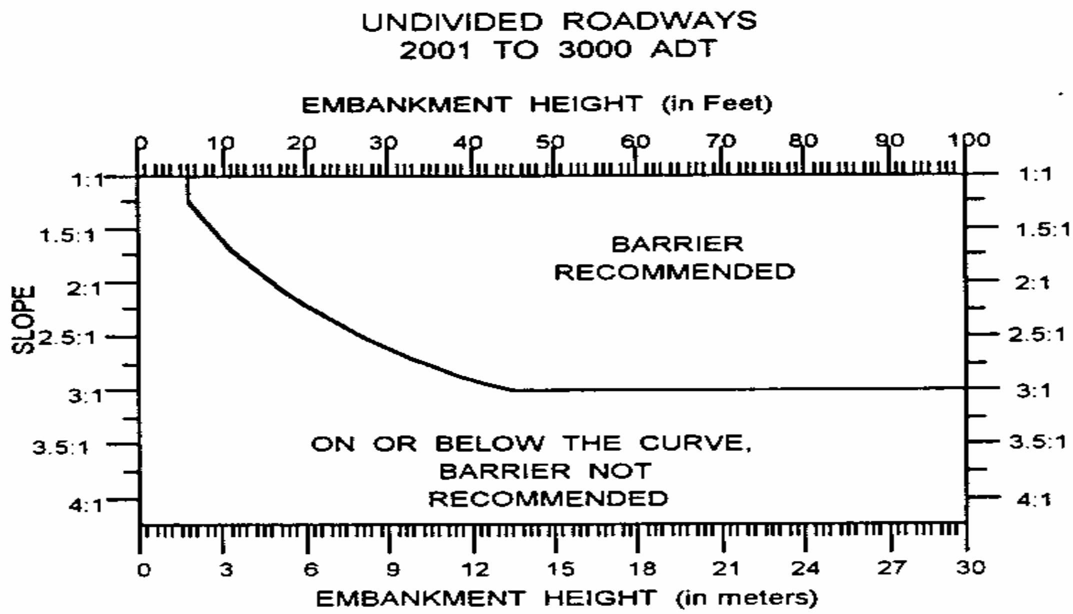
570.04 Fill Slope Parameters. The height and slope of roadway embankments are the basic factors in determining shoulder guardrail need. For low, flat embankments, out-of-control vehicles can "ride out" a slope with less hazard than associated with striking a guardrail. For high, steep embankments, the hazard of being redirected by a guardrail is less than if the vehicle is permitted access to the slope.

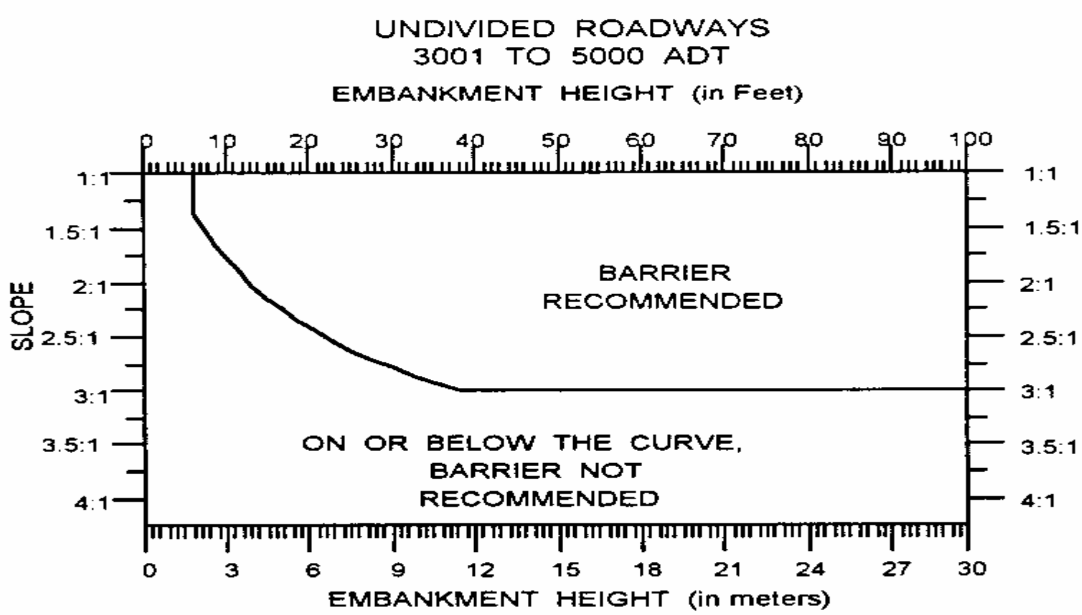
In Figure 5-8, sheets 1 through 3, an extrapolation of fill height and slope which falls above or to the right of the curve indicates an embankment hazard of a greater severity than a guardrail. A slope and height combination which falls on or below the curve indicates an embankment which is less hazardous than a guardrail.





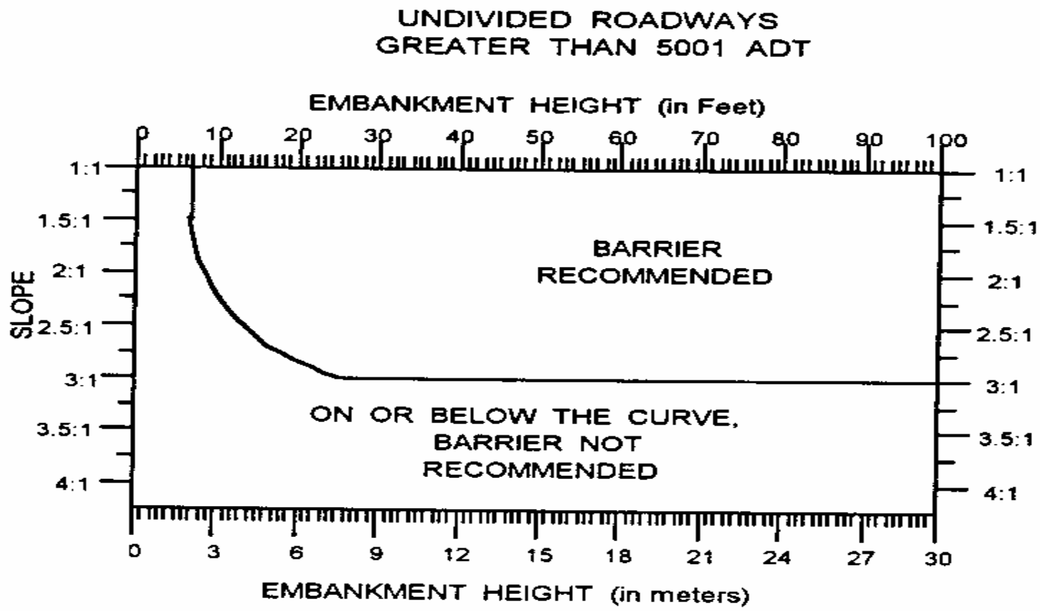
GUIDELINES FOR EMBANKMENT BARRIER

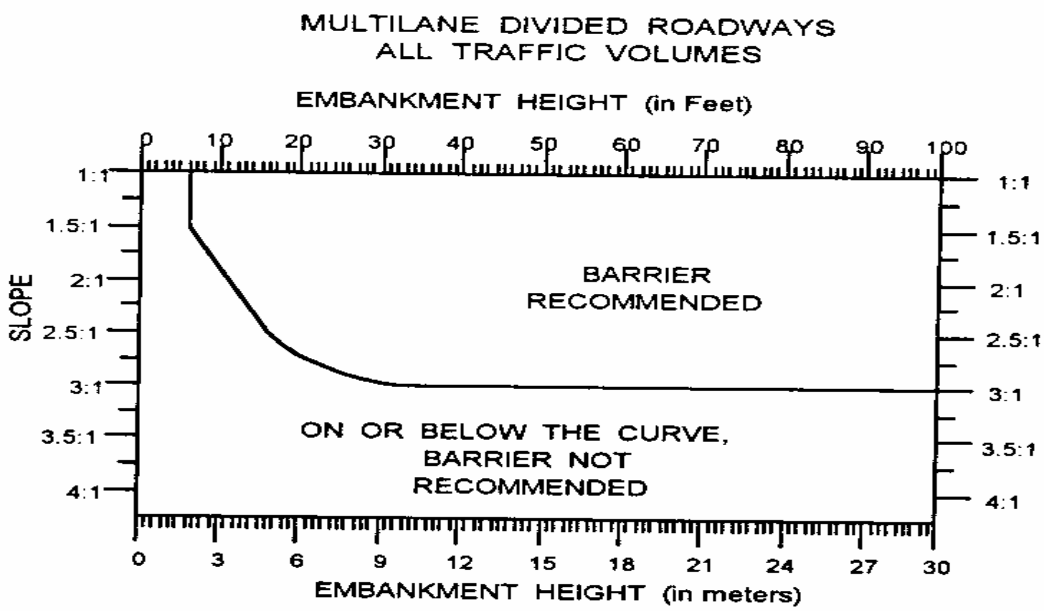




GUIDELINES FOR EMBANKMENT BARRIER

Figure 5-8





GUIDELINES FOR EMBANKMENT BARRIER

Additionally, other conditions such as fixed hazards, length of advancement, horizontal and/or vertical alignment, route discontinuity, narrow lanes, narrow shoulders, inadequate superelevation on curves, long grades, lane drops, skid resistance, etc., are based on probable collision frequencies and may warrant a higher level of protection than that suggested in the figures. Where guardrail is required for appropriate embankments, the length should be extended to prevent vehicle penetration behind the guardrail into the protected area.

570.05 Standard Guardrail and Terminal Usage. Guardrail Terms (Figure 5-9) defines current standard guardrail terms. Figure 5-10 addresses Standard Guardrail and Terminal Usage. Included are the bid item numbers, corresponding standard drawings, names of the items, and the uses for each. Additionally, various Barrier Terminals are addressed in Figure 5-11.

When providing alternates, such as a transition or additional guardrail, any additional cost associated with one system as compared to another should be accounted for.

Figure 5-9

GUARDRAIL TERMS	
System	The common name of existing crash-tested terminals. CAT, ADIEM II and ET2000 are brand names for devices of the Syro Steel Company. SENTRE, TREND, GREAT, LMA, and BRAKEMASTER are brand names for devices of Energy Absorption Systems, Inc. NCIAS is a narrow-impact attenuator system developed by Connecticut. ELT (Eccentric Loader Terminal), and MELT (Modified Eccentric Loader Terminal) are non-proprietary devices. The BEST terminal is patented by Interstate Steel Co. in Texas. The SKT-350 is the brand name for the device of Universal Industrial Sales.
Median, Roadside, Crash Cushion	The intended use of the barrier terminal, Median refers to a device designed to redirect a vehicle striking either side. When designated as a crash cushion, it has met the crash cushion criteria and may be used in narrow locations.
Width	Aboveground dimensions.
Offset (Flare)	The distance off the tangent line that is required for the terminal.
Length	The total length of the installation, exclusive of any needed transition, unless otherwise indicated.
Transition Required	If an additional section is required, when the terminal is to be used with a rigid system or object.
Distance beyond Length of Need	The distance of the terminal will extend beyond the determined length of need for the barrier.
Initial Cost	The cost varies greatly from location to location and from project to project. The value should be considered to be relative and not absolute.

Figure 5-10

STANDARD GUARDRAIL AND TERMINAL USAGE

BID ITEM	STANDARD DRAWING	NAME AND USE
612-005A	G-2-A-1,2,3	**W-Beam Metal Guardrail** - Standard Metal Guardrail Installation with 3' (1.8 m) and 7'4" (2.2 m) posts.
612-050A	G-1-B	**Metal Terminal Section Type 1** - Use on trailing ends of guardrail installations when rail extends 50' (15.3 m) beyond the point of need.
612-055A	G-1-B	**Metal Terminal Section Type 1A** - Use on trailing end of guardrail installation when rail does not extend 50' (15.3 m) beyond the point of need.
612-060A	G-1-C	**Metal Terminal Section Type 2** - Use in conjunction with a back slope.
612-065A	G-1-E	**Metal Terminal Section Type 3** - Use to attach metal rail with concrete bridge parapet or concrete to metal guard rail connector, G-2-D (m).
612-070A	G-1-J	**Metal Terminal Section Type 4** - Use for rural installation to terminate metal rail at a railroad crossing.
612-075A	G-1-F	**Metal Terminal Section Type 5** - Use to terminate metal rail under normal conditions.
612-080A	G-1-H	**Metal Terminal Section Type 7** - Use to terminate metal rail when an approach roadway must be accommodated and a type 5 cannot be installed.
612-085A	G-1-H	**Metal Terminal Section Type 8** - Use at the end of the type 7 when located outside the clear zone or the approach roadway speed is less than 35 mph (55 km/h).
612-090A	G-1-K	**Metal Terminal Section Type 9** - Use as a retrofit for the old type 3 terminals only. Not used on new construction
612-150A	G-2-A	**Concrete Guardrail** - Standard Concrete Guardrail Installation.
612-155A	G-2-A	**Concrete Terminal Section Type A** - Use to terminate concrete rail. Not used in the clear zone except on trailing ends.
612-165A	G-2-D	**Precast Concrete Guardrail Connector**- Use to connect metal rail to concrete rail.
612-170A	G-2-E	**Precast Concrete Guardrail Transition** - Use to connect Bridge Type IV Parapet to concrete rail.
	G-1-L	**Guardrail Placement For Minor Structures And Large Culverts** - Use to span structures up to 18'(5.5 m) without mounting posts on the structure.
	G-2-F	**Interim Bridge Rail Retrofit** - Use to bring substandard bridge parapet up to present standards.
	G-2-H	**Special Cast In Place Concrete Guardrail** - Use when structure piers are within the clear zone and there is insufficient room for Standard Rail Installation.
612-095A	G-1-M	**Metal Terminal Section Type 10 –** Use in place of type 5 when cannot construct pad for 4' offset.

PERMANENT BARRIER TERMINALS (DIMENSIONS IN METERS)

SYSTEM	Median (bi-directional)	Roadside	Crash Cushion	Width	Offset (Flare)	Length	Transition to Rigid System Required	Distance beyond Length of Need	Initial Cost Category	Comments
CAT	X	X	X	~0.6	0	9.5	YES	5.7	C	
QUAD GUARD LMC	X	X	X	.9-2.3	0	10	NO	1.0	E	
QUAD GUARD	X	X	X	.6-2.3	0	1.7-11.8	NO	1.0	E(2)	
BRAKEMASTER 350	X	X	X	0.6	0	9.6	YES	5	D	Median must be 6 m or wider. Clear zone required.
QUAD TREND 350		X	X	0.4	0	6.1	NO	1.5	C	Clear zone required.
REACT 350	X	X	X	0.9	0	4.9, 9.5	NO	1.3	E(2)	
SAND BARRELS (1)	X		X	≥2.1	*	(2)	NO	(1)	C(2)	*Align with vehicle approach. Little or no redirection capability.
SKT 350		X		0.3	0	15.2	YES		C	
CABLE	X	X	Use limited to terminating cable barrier systems.							
NCIAS (1)	X		X	0.9	0	8.2	NO	(1)	E	Although NCIAS does not require a transition, it does require a backup support.
ET2000		X		~0.6	0	15.2	YES	3.8	C	Generally used as a roadside terminal for semi-rigid systems.
BEST		X		~0.6	0	15.2	YES	3.8	B	Generally used as a roadside terminal for semi-rigid systems.
REGENT 350	X	X		~0.6	1.2	11.4	YES	7.6	B	
CIAS		X	X	3.8	0	8.6	NO	See spec	E	Although CIAS does not require a transition, it does require a backup support.

Initial Cost Categories	**A** — $500	**B** — $500 to $1,500	**C** — $2,000 to $7,000	**D** — $7,500 to $12,500	**E** — $15,000 to $25,000

(1) The NCIAS AND SAND BARRELS were crash tested as crash cushions and are generally considered more appropriate for crash cushion situations and median applications; although they could be used for specific roadside situations. Because they were not tested as roadside barriers, they are expected to be used beyond the required length of need, even though the NCIAS does possess some redirectional capabilities.

(2) The length of the QUAD GUARD, REACT 350, and SAND BARRELS varies, since their design is dependent upon speed. Costs indicated are for a typical 60 mph (95 km/h) design.

(3) The Experimental/Operational status will be determined by each state agency. Evaluation of in service performance is highly desirable, particularly for new types of terminals.

570.06 Guardrail Adjacent to Piers. To protect motorist from grade separation piers, use following guidelines to keep guardrail design consistent:

Situation 1: Face of guardrail 4 feet (1.2 m) or greater from the pier

Option a: Guardrail can be continued past the pier with no modification.

Situation 2: Face of guardrail 2’ 6” (0.75 m) to 4’ (1.2 m) from the pier

Option a: Use W-beam guardrail with double rail and 3 feet 1 ½ inches (0.95 m) post spacing. If pier footing interferes with post lengths, attach to footings according to Standard Drawing No. G-1-L.

Option b: Use concrete guardrail.

Situation 3: Face of guardrail less than 2’ 6” (0.75 m) from pier

Option a: Use special cast-in-place concrete guardrail (Standard Drawing No. G-2-H). The guardrail may be placed closer to or farther from the shoulder than the 2’ (0.6 m) as shown on Standard Drawing No. G-1-A. However, the guardrail should not encroach onto the shoulder.

570.07 Safety Barriers. All blunt ends, unconnected bridge rails, and grossly substandard rail (including cable, half-moon, non-blocked out rail and rail that varies more than 80 mm from standard) will be upgraded to current standards on **all** projects. (See Figure 5-13 for approved devices).

570.08 Additional Guardrail Considerations. ITD and FHWA have agreed that all blunt ends, unconnected bridge rails, and grossly substandard rail will be upgraded to current standards on all NHS routes by the year 2005.

570.09 NCHRP-350 Implementation.

The Division of Highways is dedicated to a safe and efficient highway system and is committed to replacing or removing all blunt ends, turned-down ends, unconnected bridge rails and grossly substandard on all projects. Cable, half moon, non-blocked rail and rail that varies by more than 80 mm from standard is considered grossly substandard.

The DOH will follow NCHRP-350 (safety and crashworthiness of roadway features) requirements. NCHRP-350 only applies to routes on the National Highway System (NHS), however, to avoid confusion and dual inventories (NHS vs. non-NHS); NCHRP-350 will apply to all portions of the State Highway System. All construction, maintenance, and utility work on the State Highway System shall utilize crashworthy hardware. On non-NHS roadways under local control, the DOH encourages the implementation of the NCHRP-350 requirements.

The Division of Highways is committed to replacing or removing the remaining 244 blunt ends and unconnected bridge rail on the NHS.

Figure 5-12

NCHRP-350 Crash Test Requirements for Work Zone Safety Devices

Work zone safety devices shall conform to the following requirements:

Category	Included Devices	Compliance Requirements	Other Information
1	Low-mass, single piece traffic cones, single piece drums, tubular markers, flexible markers and delineators. Note: If auxiliary lights or signs are attached, it is considered a Category 2 device.	New units purchased after October 1, 1998 must comply with NCHRP-350. Contractors must submit a signed affidavit listing vendor's names and model numbers for all devices used on the project. This list must be approved by ITD before use.	
2	Barricades (Types 1, 2 & 3), portable sign stands with signs, vertical panels, drums w/lights, intrusion alarms & other devices under 45 kg.	New units purchased after October 1, 2000 must comply with NCHRP-350.	
3	Includes Category 2 devices exceeding 45 kg and/or "expected to cause significant occupant velocity change"; work zone crash cushions, portable concrete barriers and truck mounted attenuators (TMAs).	All TMAs, crash cushions, and concrete barriers purchased after October 1, 2002 shall comply with NCHRP 350.	All existing devices that comply with NCHRP-230 and/or 350 may be used until their service life is exhausted.
4	Portable changeable message signs, arrow displays & other trailer type devices (portable traffic signals, etc.).	Purchased after October 1, 2002 shall comply with NCHRP 350.	

Figure 5-13

NCHRP-350 Requirements for Permanent Installations

Devices installed for permanent use shall conform to the following requirements and dates[(1)]:

Safety Hardware Type	New Installations[(2)]	3R Projects[(3)]	System-wide Replacement
Guardrail to Bridge Rail Transitions	October 1, 2002 (By October 1, 1998 devices must meet NCHRP-230)	October 1, 2002 (Replacement of existing hardware meeting NCHRP-230 is not required.)	According to ITD/FHWA agreement, all unconnected bridge rails shall be upgraded.
Guardrail Terminals	October 1, 1998	October 1, 1998 (Replacement of existing hardware not meeting NCHRP-350 is required.)	All blunt end terminals shall be upgraded.

(1) The indicated deadlines reflect the date a construction project is advertised for bid or when the feature is installed by state forces.

(2) New installations are defined as follows: The placement of a device where none previously existed or where an existing feature is extended. Unless otherwise indicated and at the District's discretion, existing features may be retained in part or in their entirety if left undisturbed. Replacement of damaged longitudinal barriers may be replaced in kind.

(3) On new construction and 3R (Resurface, Restoration, and Rehabilitation work that retains the integrity of the existing ballast, including such work as rotomill-inlay/overlay, overlay, bridge deck rehabilitation, and modifying bridge rail) projects, all TMAs and crash cushions purchased after October 1, 1998 shall comply with NCHRP-350.

(4) Breakaway support hardware previously found acceptable under the breakaway requirements of either the 1985 or 1994 editions of the AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals* are acceptable under NCHRP-230 or 350 guidelines. The July 25, 1997, FHWA memorandum exempts utility poles and signal supports from the NCHRP-350 requirements.

SECTION 575.00 – GRADING FOR GUARDRAIL

Roadway subgrade must receive special grading to accommodate the subsequent installation of guardrail, regardless of the type. As noted in the Standard Drawings, a desirable distance of 2’ (0.6 m) of subgrade should be provided behind the guardrail posts with special grading for guardrail end flares. Special grading for guardrail should be noted on the roadway profiles so the grading for guardrails is not overlooked during subgrade construction. **The roadway pavement must be widened, with or without an embankment protection curb, to extend underneath the guardrail face to eliminate base subgrade erosion that could create a vehicle wheel trap adjacent to the guardrail.** Special attention of this additional paving should be noted as the widening must be constructed prior to the guardrail installation.

Collision research testing indicates that a longer guardrail post, 7’ 4” (2.2 m) 4 feet 8 inches(1.4 m) minimum embedment), is adequate on steeper foreslopes. While it is still desirable to provide 2’ (0.6 m) of embankment behind guardrail posts, the aggregate base can be hinged behind the post when 7’ 4” (2.2 m) guardrail posts are specified. If the 7’ 4” (2.2 m) posts are used, the surfacing shall continue beyond the posts to the hinge point. The 7’ 4” (2.2 m) posts should only be considered for existing roadways where additional embankment fill material would be expensive, inconvenient, and environmentally undesirable, or in special cases, where a wider embankment is not economical.

Justification for using the 7’ 4” (2.2 m) guardrail posts, including a cost-effective analysis, must be in the Project Concept Report narrative or within the ITD-783B Alternate Solutions and Costs.

SECTION 580.00 - MAILBOXES

Mailboxes may be a hazard to the traveling public and should be considered an intrusion into the clear zone.

New mailboxes conforming to the standard drawings shall be constructed on all projects that require removal of the existing mailboxes during construction. The height of the mailbox should be coordinated with the local postmaster.

Mailbox turnouts should be constructed on all NHS Highways and on all non-NHS highways with a current ADT of 400 or greater.

SECTION 585.00 – SPECIFIC PROJECT DESIGN STANDARDS

The following types of projects have specific project design standards that are detailed in Appendix A:

- 3R Improvements — Interstate System
- 3R Improvements — National Highway System
- State Design Standards for Non-NHS
- Pavement Rehabilitation (1R) Standards
- Rest Area Design
- Pedestrian Overpasses, Underpasses, and Ramps
- Bicycle Facility Design

REFER TO APPENDIX A FOR DESIGN CRITERIA FOR SPECIFIC PROJECTS

SECTION 590.00 – TURN BAYS/TURN LANES

The desirable width for turn bays/turn lanes is 14’ (4.3 m). If a turn bay/turn lane is proposed on a project for a width other than 14’ (4.3 m) it shall be documented and justified in the concept report and submitted to Roadway Design for approval.